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ABSTRACT

Examined in two studies with a total of 4,673 hearing impaired and 618 hearing students were the implications of language differences on the linguistic presentation of instruction and computer assisted instruction to the hearing impaired. In the first study, item responses on the Stanford Achievement Test Hearing Impaired Version (SAT-HI) were factor analyzed in an initial effort to identify potentially aberrant linguistic structures. In the second study, item p-values on the SAT-HI were analyzed for item bias. Identified as misleading for hearing impaired students were the following six linguistic structures: conditions (if, when), comparatives (greater than, the most), negation, inferentials (should, could, since), low information pronouns (it, something), and lenghty passages. (Author/DB)

LINGUISTIC PRESENTATION OF CURRICULUM AND CAI TO HEARING IMPAIRED STUDENTS

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Abstract

Two investigations into linguistic presentation of instruction to hearing impaired students are summarized in this report. In the first study, item responses by a national sample of 1852 hearing impaired students were factor analyzed in an initial effort to identify trends in terms of potentially aberrant linguistic structures. In the second study, item p-values determined by national samples of 618 hearing and 2821 hearing impaired examinees were analyzed for item bias. From these two investigations, six trends in terms of linguistic structures which appear to be misleading for hearing impaired students were identified and supported. It is suggested that these linguistic structures be used cautiously in developing curriculum and CAI for deaf students.

One underlying concern in all curriculum development efforts, be it textbooks for hearing students or CAI for hearing impaired students, is how to best present information. Work on the utility of definitions (Klausmier and Feldman, 1975; Tennyson and Boutwell, 1974); the efficiency of exemplar vs non-exemplars (Merrill 1971; Tennyson, Wooley and Merrill, 1972; Tennyson, 1973); and discovery vs expository learning (Roughead and Scandura, 1968; Scandura and Durnin, 1968); have all dealt with instructional strategies and global schemes to enhance learning. But as Tennyson and Boutwell (1974) illustrate, the language used to present a concept is as important if not more important than incorporated strategies.

Since the languages used by hearing impaired students differs from "standard English", a prime question then is what linguistic structures are most and least effective for use with this population? In developing curriculum, one would want to avoid using constructs that cause undo difficulty for these students. To say this in another, more direct way: the best instructional strategy will fail, if the kids cannot understand the materials. Conversely, one would want to use linguistic structures that are most facilitative to learning.

In this presentation, I would like to discuss some of the research I have seen conducting with regard to linguistic structures and deaf education. No doubt, some of these findings will have direct implications for your work as curriculum/CAI developers.

To begin an investigation into linguistic strengths and weaknessess one can preseent a large number and variety of linguistic structures to a large number of subjects. This occurs frequently in the form of standardized testing.

In an initial exploratory investigation (Rudner, 1976a), I was able to obtain from the Office of Demographic Studies (ODS), Gallaudet College, item responses to the Stanford Achievement Test Hearing Impaired Version (SAT-HI) Level 2 battery made by a national sample of 1852 students enrolled in special education programs for the hearing impaired. These items formed an item-response pool.

The items within each subtest of the SAT-HI were subjected to separate one-factor principle axis analyses (with iterations). Items which correlated highly with (had a high factor loading on) the ability inferred by the respective subtest, were considered to be appropriate in terms of content, words and linguistic structure. On the other hand, items with low factor loads ($r < .25$) were classified as potentially aberrant for use with this population.

From a single item, one has difficulty inferring the cause of aberrance. Linguistic, age, social and other forces all have an effect. However, by collecting such items and conducting a content analysis of their linguistic structures, trends were able to be identified. These trends can be interpreted as trends in linguistic structures which appear to be misleading to hearing impaired examinees. These identified trends are summarized in Table 1.

Insert Table 1 about here

Because of the statistic utilized the study was designed to be exploratory. That is, the trends identified cannot be considered definative. Items may be aberrant due to a number of causes of which linguistic structure is just one. To obtain possible support for the above findings, the problem was tackled again. (Rudner, 1976b), this time using a different approach and different data. This different approach utilized a newly emerging method analyzing item bias. If hearing impaired students cannot handle specific linguistic structures appearing on a test developed for a normal hearing population, one would expect the same linguistic structures to cause items to be biased against the deaf. In this study, the item difficulty regression method (Angoff, 1973, Echternacht, 1974) was used to identify biased items.

"In this approach, indices of item difficulty - -i.e. p-values - - are obtained for two different groups on a large number of items. Each p-value converted to a normal deviate (z-score) and the pairs of normal deviates, one pair for each item, are plotted on a bivariate graph" (Angoff, 1972, p.1). The plot will generally be in the form of an ellipse. Items greatly deviating from the main axis of the ellipse (the regression line) may be regarded as exhibiting a meaningful item by group interaction. That is, relative to the other items, such deviant items are comparatively more difficult for members of one group then they are for the other[1].

Since item bias occurs in degrees, defining "greatly deviant" poses a problem. One approach has been to use a traditional form of outlier analysis. An alternatate approach adopted for use in this analysis was to arbitrarily set a fixed item-regression line distance of .75 z-score units and classify as biased those items beyond it.

In order to utilize Angoff's approach, the only item statistics needed are the within group item p-values. Since this type of data was readily available for hearing and hearing impaired examinees in an earlier ODS report (Trybus and Buchanan, 1973), the author decided to conduct the second investigation on this data. Specifically, the data included sets of item p-values on the 1964 version of the Stanford Achievement Test battery, Intetmediate I, subtests determined by 1) 618 hearing examinees and 2) 2821 hearing impaired examinees. Hearing examinees were those used in an equating study by the test publishers Harcourt, Brace and Jovanovich. Hearing impaired examinees were part of those utilized 1971 Annual Survey of Hearing Impaired Children and Youth (see Rawlings, 1973.

Figure 1 provides a visual representation of the item difficulty regression plot of the Social Studies Subtest. The correlation of the transformed p-values is fairly high

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[1]Copies of a FORTRAN computer program and procedures for hand calculation of this approach are available from the author.

(r = .826), as indicated by the elongated shape of the ellipse. The items outside and above the confidence interval are biased in favor of hearing impaired examinees; those outside and below, in favor of hearing examinees.

Insert Figure 1 and Table 2 about here

From Table 2, it can be noted that almost all of the items biasd in favor of hearing examinees fell into one of the six categories outlined in Table 1. Hence, this study provides support for the trends identified in the earlier study.

Efforts were made to hypothesize trends in items biased in favor of hearing impaired examinees. Such trends would provide a framework of unique strengths which could further facilitate educational efforts. However, since the number of such items in this study was relatively low, no consistent trends could be identified. Further work is needed in this area.

The author wishes to emphasize that these results are not to be interpreted as definitive. The intent of this and the earlier study is solely to identify trends. Therefore, items utilizing one or more of these linguistic structures will not automatically be poor for use with the hearing impaired. There will always be exceptions. Item 21 of the

Word Usage Subtest, for example, contained a negation. Yet it appeared biased in favor of the hearing impaired examinees.

Nevertheless, the study has implications for testing and instruction. In developing a measure for the hearing impaired, the test developer should avoid, or at least be cautious of, the constructions identified as aberrant. In curriculum and teaching, one would want to use these formats carefully. It may be tempting to avoid these linguistic structures completely. However, since they are common to everyday English, one may feel that mastery is necessary. If so, then the CAI or curriculum developer for the deaf might also exert effort in this direction as well.

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Table 1

Linguistic Structures which Appear to be Misleading for Hearing Impaired Students

1. Conditionals (if, when)
2. Comparatives (greater than, the most)
3. Negation (not, without, answer not given)
4. Inferentials (should, could, because, since)
5. Low Information Pronouns (it, something)
6. Lengthy passages

Figure I

Scatterplot for the Social Studies Subtest

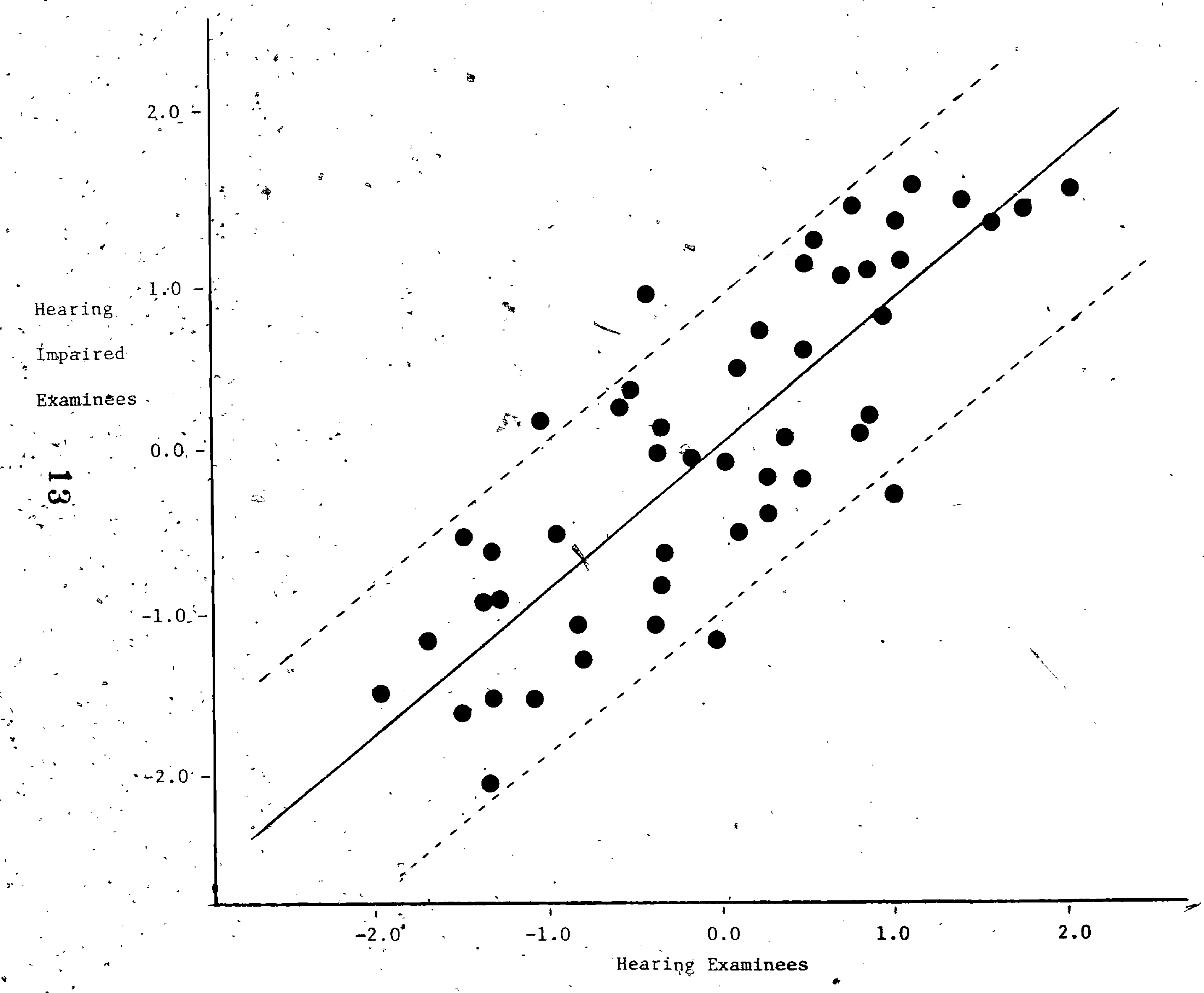

Table 2

Format Analysis of the Items Identified

As Biased in Favor of Hearing Examinees

Subtest	Item #	Distance	Item Format
SPEL	46	1.049	
WUSE	14	.838	
WUSE	16	1.150	Negation (correct answer - neither)
WUSE	17	.856	Comparative (more than)
WUSE	18	1.003	Negation (never)
WUSE	20	.758	
WUSE	28	.916	Negation (correct answer - neither)
PUNC	50	1.715	Negation (no punctuation needed)
CAPT	59	1.082	Negation (no capitalization needed)
DICT	99	.985	Comparative (opposite of)
SENT	111	1.180	Conditional (when)
SENT	112	2.041	Inferential (since), Negation (not a complete sentence)
SENT	114	1.808	Low information pronoun (objects), Negation (not a complete sentence)
SENT	119	.954	Negation (not a complete sentence)
MCON	17	.875	Comparative (greater than)
MCON	21	1.297	Comparative (the greatest)
MCON	22	.928	Conditional (if)
MAPP	14	.849	
MAPP	21	.960	Negation (correct answer - not given)
SOST	4	.874	Conditional (when)
SOST	15	.781	Comparative (most)
SCIE	7	.832	Comparative (the warmest)
SCIE	8	1.030	Inferential (because)
SCIE	10	1.317	Inferential (because)
SCIE	23	.779	Lengthy paragraph
SCIE	31	.791	Comparative (higher than)